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Treatment of cabin air

Abstract:

Abstract of GB2341094

Commercial aircraft usually re-circulate at least part of the air in the aircraft cabin, replacing a proportion of the air with air from outside the aircraft. The cabin pressure during high altitude flight is maintained at a value above the external pressure though below normal atmospheric pressure. At least the re-circulated air is treated by passing it through a non-thermal plasma device, the device being energised continuously whilst the aircraft is in use. This ensures that any micro-organisms are killed, so insuring that infectious diseases are not transmitted with the re-circulated air. The non-thermal plasma device might be a packed pellet bed, or a silent corona discharge, or a microwave reactor. Data supplied from the esp@cenet database - Worldwide

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(54) Abstract Title
Treatment of cabin air

(57) Commercial aircraft usually re-circulate at least part of the air in the aircraft cabin, replacing a proportion of the air with air from outside the aircraft. The cabin pressure during high altitude flight is maintained at a value above the external pressure though below normal atmospheric pressure. At least the re-circulated air is treated by passing it through a non-thermal plasma device, the device being energised continuously whilst the aircraft is in use. This ensures that any micro-organisms are killed, so insuring that infectious diseases are not transmitted with the re-circulated air. The non-thermal plasma device might be a packed pellet bed, or a silent corona discharge, or a microwave reactor.

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Treatment of Cabin Air

This invention relates to a method for treating air in an aircraft or spacecraft cabin to remove contaminants.

Commercial aircraft usually re-circulate at least part of the air in the aircraft cabin, replacing a proportion of the air with air from outside the aircraft or from compressed air cylinders. There is consequently a concern that micro-organisms might be passed from one person to another via the air re-circulation system. This potential problem could be avoided by not re-circulating the air, and using fresh air from outside the aircraft instead; however, this would increase the fuel consumption of the aircraft. An alternative solution would be to filter the re-circulated air, but energy is wasted in overcoming the pressure drop through the filter, and if the filter were to rupture a concentrated aerosol of micro-organisms would be carried into the passenger cabin. Similar problems may arise in spacecraft.

The use of plasmas to treat gas streams has been suggested for a variety of purposes, and several different types of plasma generating apparatus have been designed. For example GB 2 282 738 describes a flow-through plasma generator in which a silent discharge is established between two electrodes, and GB 2 273 027 describes a microwave plasma generator. US 5 711 147 describes apparatus for treating exhaust gases using pulsed corona discharge, or dielectric barrier discharge, as one stage. US 4 954 320 describes the use of particulate dielectric material to pack a bed in which a plasma is generated and through which a gas stream is passed; this device may be used for decomposing toxic

gases such as phosgene, and to deactivate micro-biological spores, and is said to be usable at atmospheric and higher pressures.

According to the present invention there is provided a method of treating air supplied to a cabin of an aircraft or spacecraft to destroy contaminants such as bacteria, the pressure within the cabin being at or below normal atmospheric pressure, and the supplied air being at least partly recirculated air from the cabin, wherein the recirculated air is passed through a non-thermal plasma device, the device being energised continuously whilst air is being recirculated.

The non-thermal plasma device might be a packed pellet bed, or a silent corona discharge, or a microwave reactor. The temperature in such a non-thermal device is typically less than 200°C and may be no higher than 100°C. At such low temperatures the risk of formation of toxic chemicals such as dioxins is negligible, but nevertheless organic molecules are thoroughly oxidised typically forming water and carbon dioxide. Within the device the contaminants are subjected to ultraviolet irradiation and to bombardment by free electrons, so that any micro-organisms are killed.

The invention will now be further and more particularly described, by way of example only. The air inside the cabin of a passenger aircraft is pressurised when the aircraft is at altitude, so that the air pressure does not drop below that characteristic of an altitude of for example 3000 m; fresh air is obtained from outside the aircraft and is compressed to cabin pressure, heated to cabin temperature and mixed with re-circulated air from within the cabin. For example the air supplied to the cabin might be half fresh air and

half re-circulated air. In this example all the re-circulated air is passed through a non-thermal plasma device including a packed bed of particles of high dielectric material (for example barium titanate mixed with some alumina). In such a reactor the particles are desirably of a material of dielectric constant in the range 100 to 1000, or even higher. This plasma device is activated continuously while the air is being re-circulated (both on the ground and when in the air). Any micro-organisms such as bacteria or fungi are consequently killed during their passage through the plasma device, so that if one passenger is suffering from an infection there is no risk of transmission of the infection via the air re-circulation system.

It will be appreciated that this technique provides several benefits, in comparison to the use of conventional filters, in that the micro-organisms are killed rather than being retained (and hence concentrated); the power required to recirculate the air is reduced in that the pressure drop across the plasma device is much less than that across a filter; the risk of rupture of a filter leading to release of micro-organisms is avoided; and operating costs are reduced in that filters do not need to be changed, and used (contaminated) filters do not need to be disposed of.

Other types of non-thermal plasma device, such as a dielectric barrier (or silent discharge) reactor may be used in place of the packed bed reactor.

Claims

1. A method of treating air supplied to the cabin of an aircraft or spacecraft to destroy contaminants such as bacteria, the pressure within the cabin being at or below normal atmospheric pressure, and the supplied air being at least partly recirculated air from cabin, wherein the recirculated air is passed through a non-thermal plasma device, the device being energised continuously whilst air is being recirculated.

2. A method of treating air as claimed in claim 1, wherein the supplied air is partly fresh air.

3. A method of treating air as claimed in claim 1 or claim 2, wherein the non-thermal plasma device includes a packed bed of particles of a dielectric material.

4. A method of treating air supplied to the cabin of an aircraft or spacecraft to destroy contaminants such as bacteria, substantially as hereinbefore described.

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INVESTOR IN PEOPLE

Application No: GB 9918840.1 **Examiner:** Graham S. Lynch
Claims searched: 1 to 4 **Date of search:** 22 November 1999

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Other: On-line : WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2304576 A	RICHARDSON, ROSÉN. Whole document.	
A	GB 2287630 A	ADVANCED ENERGY SYSTEMS. Whole document.	
X	EP 0744802 A2	HE HOLDINGS. Whole document.	1, 4
A	WO 89/00355	ASTRAVENT. Pages 1 to 4.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
&	Member of the same patent family		